

ATTACHMENT A
The B-C methodology

ATTACHMENT A BLANEY-CRIDDLE METHODOLOGY

The basic B-C formula states that the consumptive use (U) is equal to a seasonal consumptive use factor coefficient (k), times a monthly consumptive use factor (f), therefore $U=k*f$. F is a function of the mean monthly temperature in degrees Fahrenheit (t) times the monthly percent of daytime hours (p), divided by 100, expressed as $f=t*p/100$. K is a factor relating the plant water usage for a specific species. K factors are generated under experimental conditions where F and U are measured under tightly controlled conditions. This analysis uses a modified B-C method beginning with a modified (k) factor, explained in Appendix B.

Here, the coefficient (k) is equal to a climatic coefficient, which is related to the mean air temperature (kt), times a coefficient reflecting the growth stage of the crop (kc), ($k=kt \times kc$). In order to approximate evapotranspiration, the following calculations must first be completed:

$$\begin{aligned} f(m) &= (t(m) \times p(m))/100, \\ kt(m) &= (0.0173 \times t(m)) - 0.314, \\ kt \ f(m) &= f(m) \times kt(m), \\ U(m) &= kt \ f(m) \times kc \ (m), \text{ where,} \end{aligned}$$

m = month of year
f(m) = monthly evapotranspiration factor
r(m) = average monthly temperature, (provided)
p(m) = monthly percentage of annual daylight hours, (provided)
kt(m) = kt
U(m) = monthly evapotranspiration
kc(m) = monthly crop coefficient, (provided)

The effective rainfall for crop evapotranspiration is calculated as a function of the 1-in-10 year drought rainfall as:

$$\begin{aligned} Rt(1) &= (0.70917 \times (Rt(m))^{(0.82416)}) - 0.11556, \\ U1(m) &= 10^{(0.01226 \times U(m))} \\ F1 &= 0.531747 + (0.295154 \times D) - (0.057697 \times D^2) + (0.003804 \times D^3) \\ Re(m) &= Rt1(m) \times U1(m) \times F1, \text{ where} \end{aligned}$$

Rt1(m) = monthly effective rainfall factor considering 1-in-10 monthly rainfall
Rt(m) = 1-in-10 monthly rainfall, (provided)
U1(m) = monthly effective rainfall factor considering monthly evapotranspiration
F1 = soil factor
D = net depth of application
Re(m) = monthly effective rainfall

After the monthly evapotranspiration, U(m), and the monthly 1-in-10 effective rainfall, Re(m), have been determined, the monthly supplemental crop requirement, Sup(m), is calculated as:

$$\text{Sup}(m) = U(m) - \text{Re}(m) \text{ for each month of the year}$$

Finally, the irrigation quantity needed to supply the supplemental crop requirement $\text{Sup}(m)$ is determined by:

$$Q(m) = \text{Sup}(m) \times K_a \times A, \text{ where}$$

K_a = allocation coefficient multiplier for the irrigation system specified

A = irrigated acreage for the crop